Comments and Communications

Phosphate Coating of Aluminum and Polymorphism of Chromium Phosphate

Articles of aluminum are usually treated by a process called bonderization or Parkerization to form a thin protective layer on the surface which gives an electrical and heat insulating coating and constitutes a good base for paint or other finishes. A recently developed method for coating aluminum is to treat the surface of the metal with a chromic acid and phosphate solution (R. C. Gibson and W. C. Russell. *Ind. eng. Chem.*, 1946, 38, 1222; C. H. Horace. Brit. Patent 398,180; J. S. Thompson. U. S. Patent 2,234,206). One sample of such a coating, light green in color, shows the following composition upon chemical analysis: coating weight, 160 mg/sq ft of surface area; Cr, 14.5%; Al, 9.8%; PO_4, 32.7%; F, 7.5%.

TABLE 1

Form	Description	Hydrate	X-ray powder method results
(I)	Light violet, freshly precipitated in cold	6	Characteristic pattern
(II)	Violet crystal transformed from (I)	6	Characteristic pattern
(III)	Green crystal transformed from (II) by heating in water	4	Diffraction pattern same as (II)
(IV)	Green crystal transformed from (II) by heating in glacial acetic acid	4	Diffraction pattern same as (II)
(V)	Fresh precipitate formed in hot solution	Not const.	No dif. pattern
(VI)	Green crystal by heating (II), (III), and (IV) at 120°	2	No dif. pattern
(VII)	Black residue obtained by igniting the above forms	0	No dif. pattern

X-ray diffraction analysis with chromium Kα radiation has been used to identify compounds present in this coating. Most of the lines correspond with those for pure aluminum phosphate prepared by mixing equivalent amounts of aluminum chloride and phosphoric acid and heating the mixture over a small flame of a Bunsen burner until no more fumes of hydrogen chloride were detectable. This pattern is entirely different from the one listed for aluminum phosphate in the ASTM Card Index. A whole series of aluminum phosphates representing polymorphism, various hydrates, and phosphoric acid forms has been found. Additional lines in the above pattern correspond to aluminum oxide and aluminum fluoride, but the chromium phosphate producing the green color is evidently amorphous. In an effort to identify this, an intensive investigation of chromium phosphates has been made, with the results shown in Table 1.

The most interesting facts are the dimorphism of the hexahydrate; identity in crystalline structure of the tetrahydrate with the hexahydrate, indicating that 2 of the 6 water molecules in the violet crystal must be zeolitic; and the amorphous nature of the compounds below the tetrahydrate. This behavior together with changes on heating indicate the presence of green chromium phosphate dihydrate on the protective coating in aluminum.

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National Science Foundation—A Peril to American Universities

Alluring as it may be, the prospect of easy and abundant Federal money for the promotion of science in universities through research grants and through contracts for research to be done for the Government seems to me to hold many perils to the freedom of the universities and to scientific education.

The first peril is that the National Science Foundation itself will be controlled by politicians rather than by scientists and that therefore the management may not always be in the hands of men whose first interest is the welfare of science, education, or educational institutions. According to the bill as now proposed, the 24 members of the Foundation, as well as its director, would be appointed by the President. Politics would inevitably play a part in such appointments. Scientists might offer advice and be consulted, but there seems to be no assurance that their advice would be heeded.

A second peril is that the director of the Foundation, because of his power to grant or to withhold research funds, would come to exercise a very real control of university policies and scientific activities. It would be naive to suppose that the agency supplying the funds would long continue to appropriate large sums over which it did not have definite control, both as to expenditure and as to the research projects to be paid for by those funds.

The allotment of research funds to universities would cause competition among them, and the funds would naturally go to the larger institutions best equipped to make good use of them. These would become even larger, and research and educational opportunities would be still further concentrated, to the detriment of the smaller institutions.

In the competition for grants, the general policies of the universities would necessarily be subject to strong pressure toward control by the Federal agency making the grants, for the university administration which is compliant and politically adept might reasonably expect to have its grants continued or increased, while the administration which is recalcitrant in any way might expect to be slighted.

Research grants for anything other than very temporary projects would create vested interests in space and personnel which would exert still more powerful

pressure toward compliance to the end that the grants might be continued.

A peril of a different kind comes from the tacit assumption that graduate students might do much of the routine work on research projects supported by the Government. I submit that scientific research projects set by outsiders, either by the Federal Government or by industry, have no proper place in a university. Routine work is not the function of a university or of its graduate students, but a contract for research must necessarily involve large amounts of purely routine work and will tend to make the university scientific staff merely the supervisors of the execution of tasks set by others than themselves, thus consuming their energies without developing their own initiative and ingenuity.

Another danger is that some of the work which the Government might wish to allot to the universities may be of a secret nature. Secret research is contrary to the whole idea of the free pursuit of and sharing of knowledge that university research is supposed to promote. If a branch of the Government desires that research be done, it should set up its own organization and hire its own men. The research jobs would be done, the universities would remain free, and their students would not be subjected to the vicious influence of secrecy in the search for knowledge.

As to the argument that the universities are in financial straits and that, therefore, government help is necessary, it would seem that scientists interested in the promotion of research, but at the same time desirous that science and the universities should remain free, would be better engaged in seeking an amendment to the income tax laws such as that proposed by King (*Science*, June 6, 1947, pp. 593–594) than in promoting the establishment of a National Science Foundation.

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A Promising Type of Male Sterility for Use in Hybrid Tomato Seed Production

While searching for male-sterile tomato plants in 1945, the writer found an interesting type of "sterility" in the variety John Baer. This mutant can be selfed by hand-pollination, but it does not self in the field, as is normally the case. It therefore can be maintained easily as a pure line through hand-pollination and can be used as a female parent in hybrid seed production without the need for emasculation. About 75% of the labor involved in hybridizing is eliminated. Natural selfing is prevented because the anthers fail to dehisce. The character appears to behave as a simple recessive. When incorporated into other desirable parental lines, it will materially reduce the cost of hybrid seed production.

Work on the "quantity collection" of pollen by means of electric-battery vibrators has been done by a large seed company, and experiments with inert diluents have been conducted intermittently during the last four years.

Thus, improvements in pollen collection and application, combined with the development of suitable "male steriles," give promise of greatly expanding the use of hybrid tomatoes.

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A Comparative Study of Zygote Germination in the Saprolegniaceae

In spite of the fact that the members of the Saprolegniaceae have been studied for over a century, the germination of the resting bodies has been reported in only a few species of the family. In order to complete the life histories of these forms, 26 species belonging to 10 genera were collected and identified. Without exception, the zygotes of all species were successfully germinated when the mycelium of each form, after a rest period, was placed in fresh distilled water which had been treated with activated charcoal, filtered, and autoclaved (A. W. Ziegler. *J. Elisha Mitchell Sci. Soc.*, 1948, 64, No. 1, in press).

The germinated zygotes fall into four types:

(A) Those in which a long or short germ tube is formed with an apical sporangium. The forms in this group included a species of *Aplanes*, and most species of the genera *Saprolegnia* and *Achlya*.

(B) Those in which the germ tube produces a sparsely branched mycelium with a sporangium at the apex of the main hypha or a branch. This type includes several species of *Isoachlya*, *Achlya americana*, and *Aphanomyces laevis*.

(C) Those in which the primary germ tube forms a branched mycelium. This group includes two species of *Isoachlya*, *Achlya glomerata*, *Aphanomyces laevis*, and *Brevilegnia linearis*.

(D) Those in which the primary germ tube forms a long, unbranched hypha. Forms in this classification include *Aphanomyces laevis* and species of *Geolegnia* and *Brevilegnia*.

The food material contained within the zygotes of the Saprolegniaceae is in the form of numerous small droplets, or one large drop of fatty reserve. Tests involving the use of Sudan III, Sudan IV, osmic acid, Nile blue sulfate, saponification, polarization, and solubilities seem to indicate that the reserve food material is true fat and that no fat-like substances are present.

Experiments involving the effects of pH on germination have demonstrated that low and high pH's tend to inhibit germination, while a pH of 6.9 allows the zygotes to germinate normally. An experiment, repeated several times, on the effects of light on germination has demonstrated that, at least for the species used in the experiment, light is necessary for germination.

A study of the literature of germinating resting bodies of other aquatic oömycetes reveals that they fall into several distinct patterns. However, these germination patterns have thrown no new light on the phylogeny of the Saprolegniaceae.

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